

Project Report: Delivery of Organic Materials to Planets

Focus Group Chair(s): David McKay

Focus Group Description & Activities

The main activity of the Astromaterials Focus Group this past year was to organize and hold a workshop at Ames to address the presence of subsets of nanomagnetites in ALH84001 and to try to determine whether they are biogenic or not. This workshop included most of the leading scientists in the country who specialize in magnetotactic bacteria, electron diffraction of nanophases, and Martian environmental characteristics. While one group from JSC claimed that they had synthetically made magnetites having all the properties of magnetotactic magnetite as typified by bacteria strain MV-1, another group disputed that claim and showed some significant differences between the synthetically produced magnetites and both the MV-1 magnetites and ALH84001 magnetites. These differences include both crystal morphology and minor element chemistry. Implications of magnetotactic bacteria on early Mars include additional support for major water bodies, additional support for an early, strong magnetic field and core dynamo, and documentation of very early life compared to Earth. Clearly, this is an extremely important topic and one that requires additional study and work. However, the evidence is very strong that ALH84001 contains true fossils in the form of nanophase magnetite.

The workshop results will be summarized and issued as a NAI report.

Focus Group Goals for Next Year

During the coming year we will work with the Astrobiology Group of the Mars Exploration Payload Assessment Group (MEPAG) and will address issues involving whether returned samples should be sterilized, and, if so, by what method. We will also address the minimum and optimum facility necessary for processing returned Martian samples. The samples will be processed in such a way as to ensure planetary protection while preserving as much as possible of any sample information that bears on the question of life. The Astromaterials Focus Group of NAI will be invited to a new workshop to discuss some of these issues.

Highlights

- The Astromaterials Focus Group studies Mars meteorites; terrestrial analogs of potential Mars samples; sample acquisition and collection technology and procedures; and develops instruments for examining astromaterials for any evidence for life.

- Some tiny magnetite in ALH84001 is still considered by many scientists to have been formed by Martian bacteria.
- Astromaterials Focus Group should be a bridge between the astrobiology community and the astromaterials community. It should strive to improve communication and understanding between these two communities.

Roadmap Objectives

- [**Objective No. 5: Linking Planetary Biological Evolution**](#)
- [**Objective No. 7: Extremes of Life**](#)
- [**Objective No. 8: Past Present Life on Mars**](#)
- [**Objective No. 12: Effects of Climate Geology on Habitability**](#)
- [**Objective No. 17: Planetary Protection**](#)

Mission Involvement

The NAI Astromaterials Focus Group will have primary responsibility for keeping up with research on Mars meteorites that bears on the question of possible life on Mars. Such information should feed into NASA Mars mission planning as part of the Astrobiology Institute's contribution to site selection, instrument requirements, operational requirements, and returned-sample requirements. The Astromaterials Focus Group should also be the main bridge between NAI and the planetary protection community. This focus group should have strong recommendations to make to mission planners for the 2009 lander mission and for the 2013 (?) sample return mission.